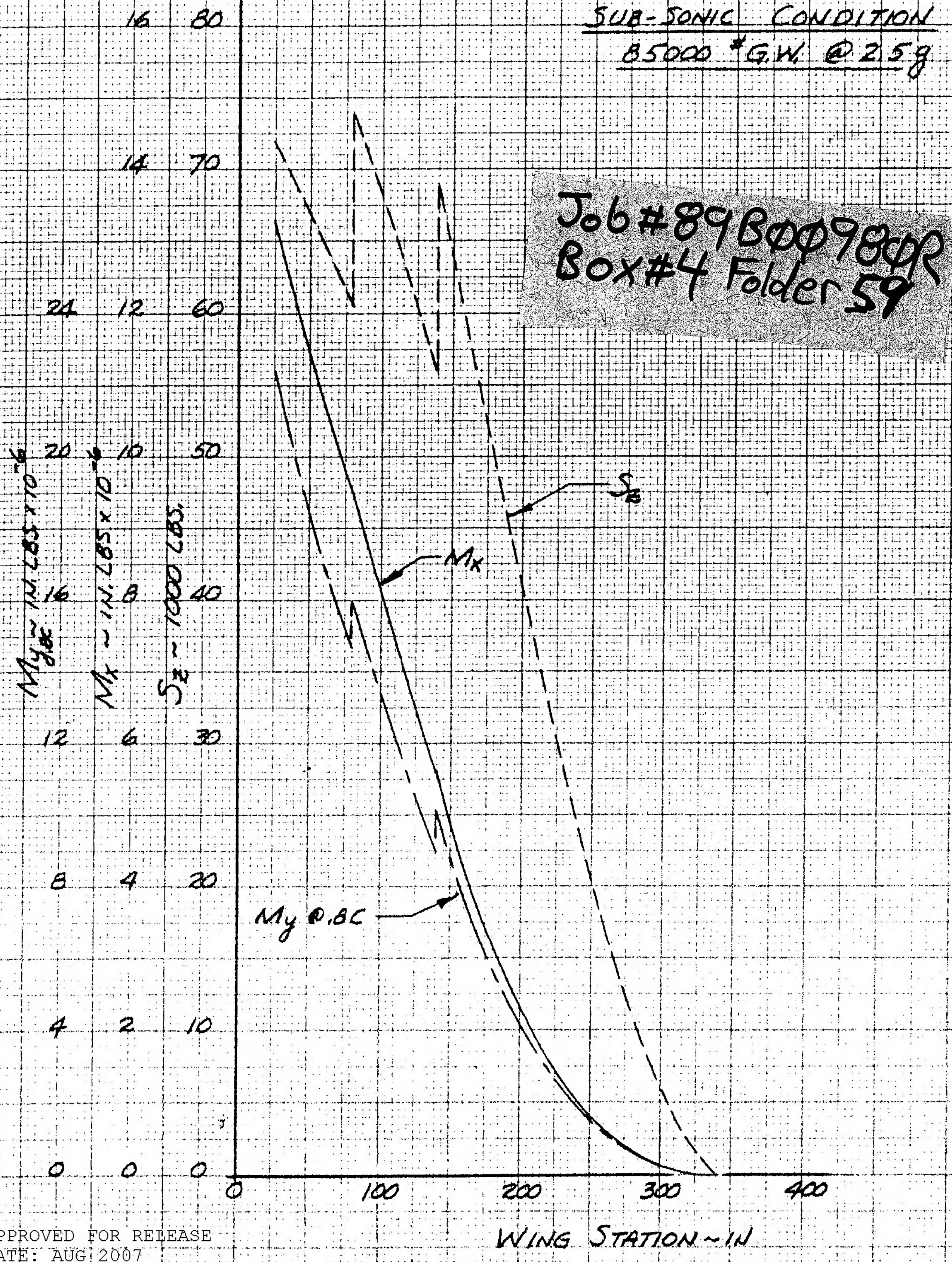
PREPARED BY
DATE
CHECKED BY

LOCKHEED AIRCRAFT CORPORATION
CALIFORNIA DIVISION

PAGE IV-17
MODEL A-11
REPORT NO.

FIG. 6

ULTIMATE WING LOADS
SUB-SONIC CONDITION
85000 # G.W. @ 2.5g



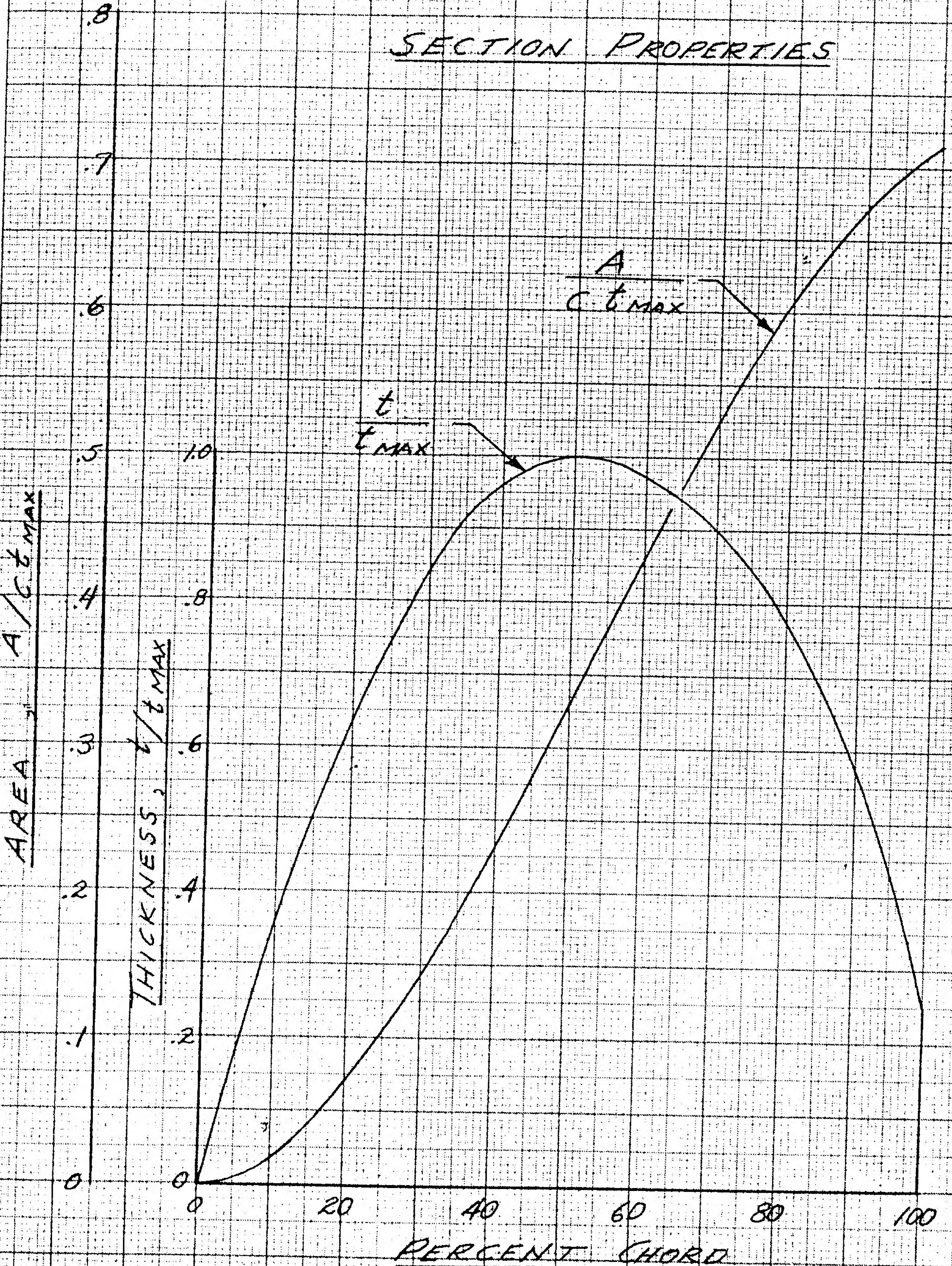
FORM 5278

WING

FIG. 7

AIRFOIL

SECTION PROPERTIES



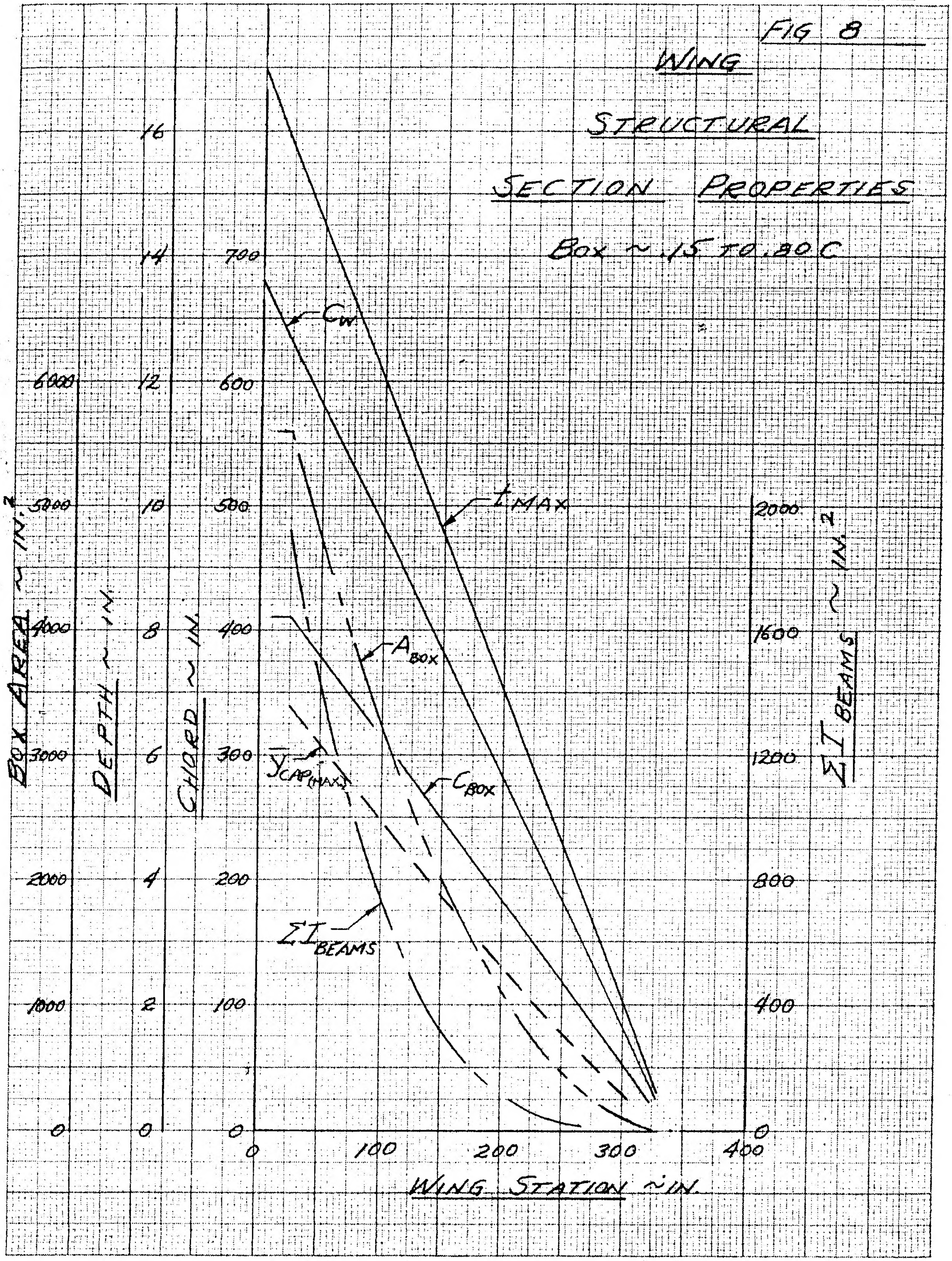


FIG 8
WING
STRUCTURAL
SECTION PROPERTIES
BOX ~ .15 TO .80 C
C_W
t_{MAX}
A_{BOX}
C_{BOX}
$\bar{y}_{CAP(MAX)}$
ΣI_{BEAMS}
BOX AREA ~ IN.²
DEPTH ~ IN.
CHORD ~ IN.
ΣI_{BEAMS} ~ IN.²
WING STATION ~ IN.
0
1000
2000
3000
4000
5000
6000
2
4
6
8
10
12
14
16
100
200
300
400
500
600
700
400
800
1200
1600
2000
0
100
200
300
400

WING (Continued)

Internal Loads and Analysis

The internal loads are calculated from the critical external loads given in Figure 6 for the subsonic room temperature condition by means of the structural section properties given in Figure 8.

The beam cap design loads, stresses and cross section areas are summarized in Figure 9. The axial load shown is for the highest loaded beam. All beams are similar in cross sections and as noted in the figure have a constant area for most of their span. This makes for ease of fabrication and is efficient because tapering of material is accomplished by the number of beams decreasing with span station. Beam caps are machined from B-120VCA titanium rolled bar.

Beam web design shear flows, stresses and web gages are summarized in Figure 10. Due to the effects of beam taper, the vertical shear in the beam webs is very low and a minimum gage of .016 sheet is sufficient. Material is B-120VCA titanium cold rolled sheet. Stiffeners are sheet metal angles of the same material spaced at approximately three inches along the beams. Front and rear closing spars are of similar construction but web gage is .040 in order to maintain the torque box stiffness.

Wing upper and lower surfaces are designed by the torsion shear flows given in Figure 11 plus the effects of bending due to air loads and, in the case of the wing fuel tank region, fuel vapor pressure. The outer skin is

WING (Continued)

Internal Loads and Analysis (Continued)

.020 B-120VCA titanium cold rolled sheet and the inner skin is .025 B-120VCA titanium sheet which is formed in the annealed state and then heat treated. The depth of the corrugation varies according to the shear stability and pressure load bending requirements along the span.

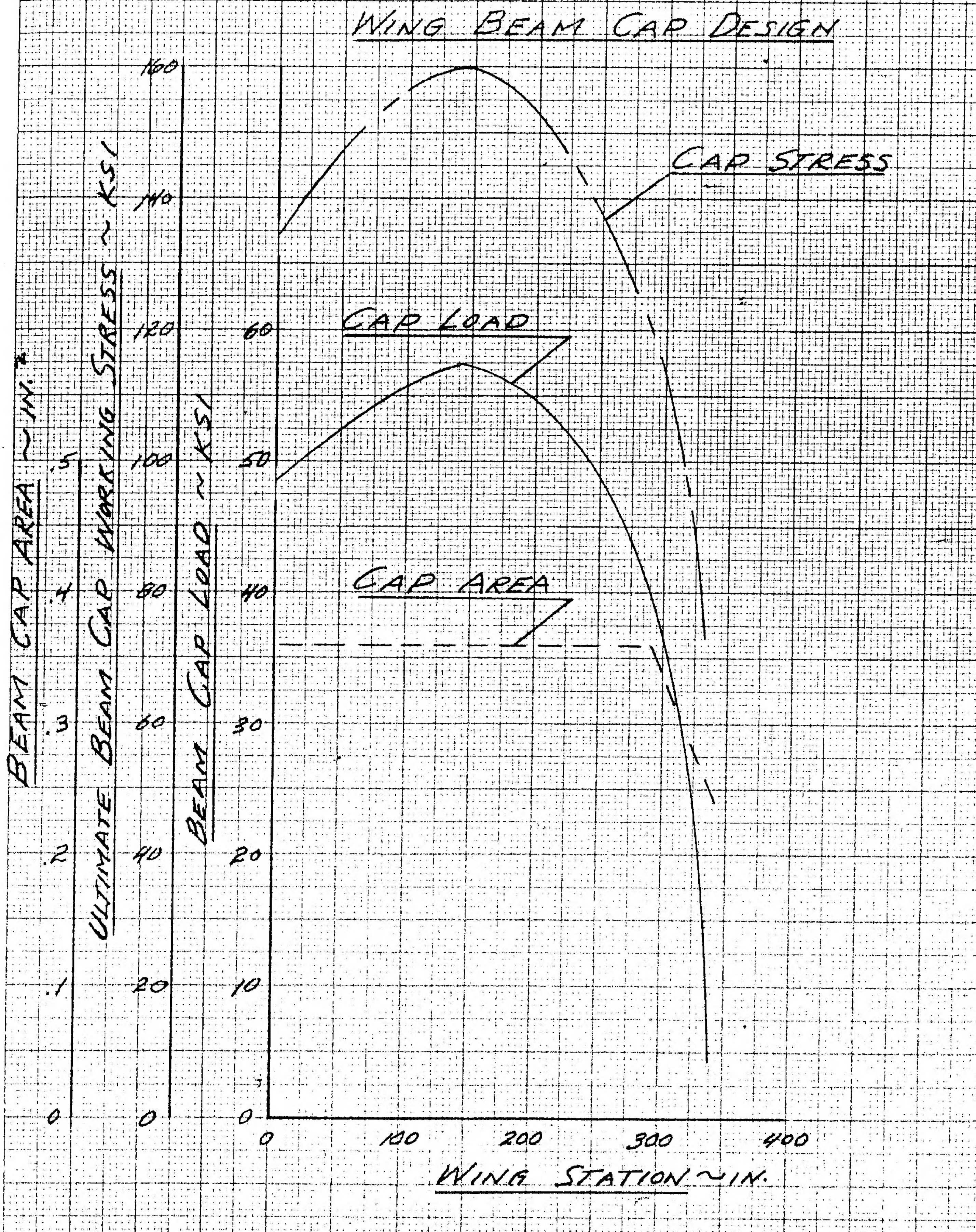
The wing torsional stiffness for aileron effectiveness is presented in Figure 12.

LOCKHEED AIRCRAFT CORPORATION
CALIFORNIA DIVISION

DATE
CHECKED BY

MODEL A-11
REPORT NO.

FIG. 9



FORM 5276

FIG. 10

WING BEAM WEB DESIGN

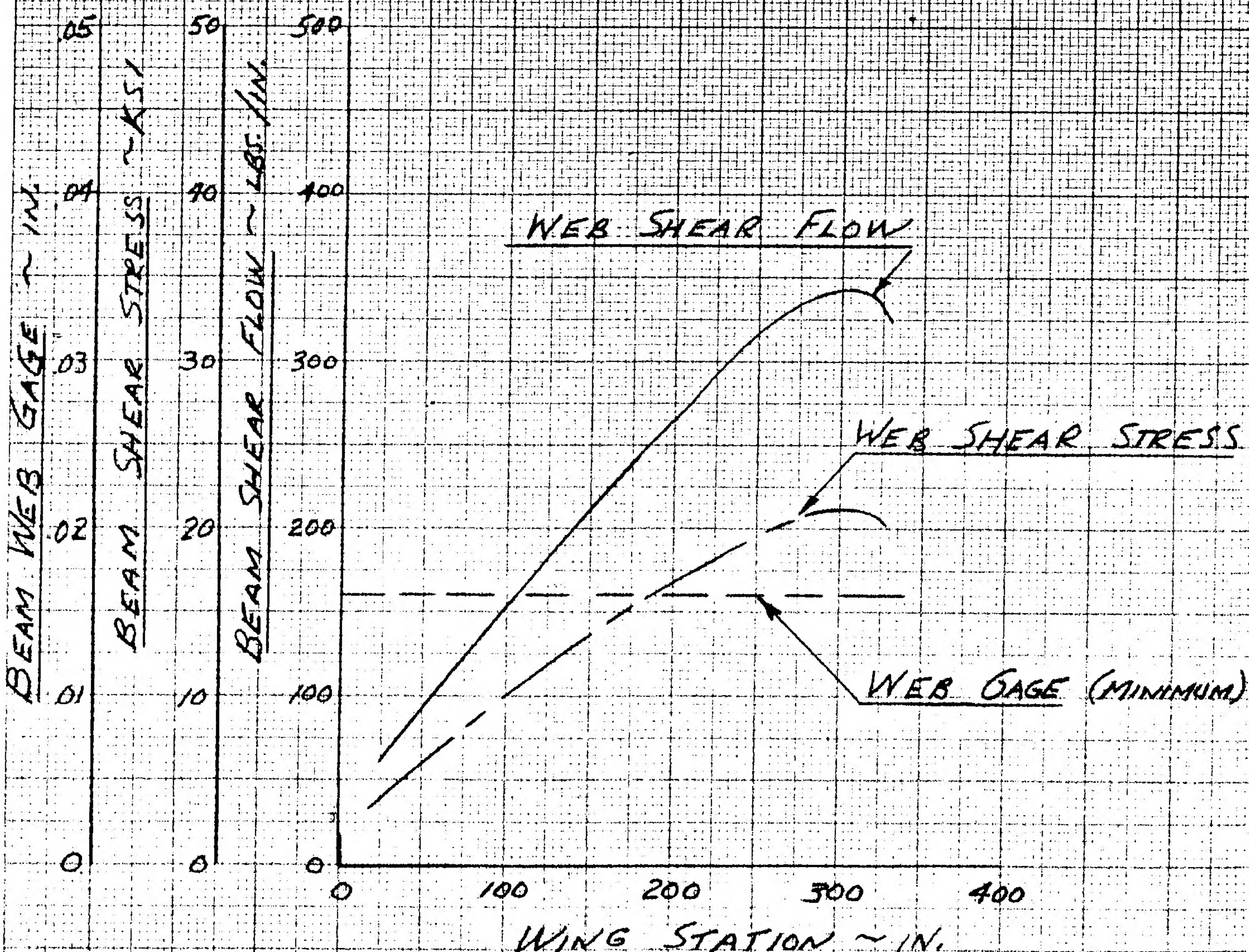
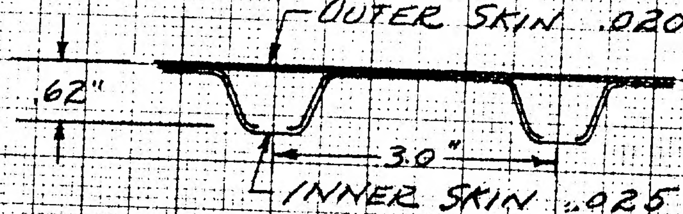
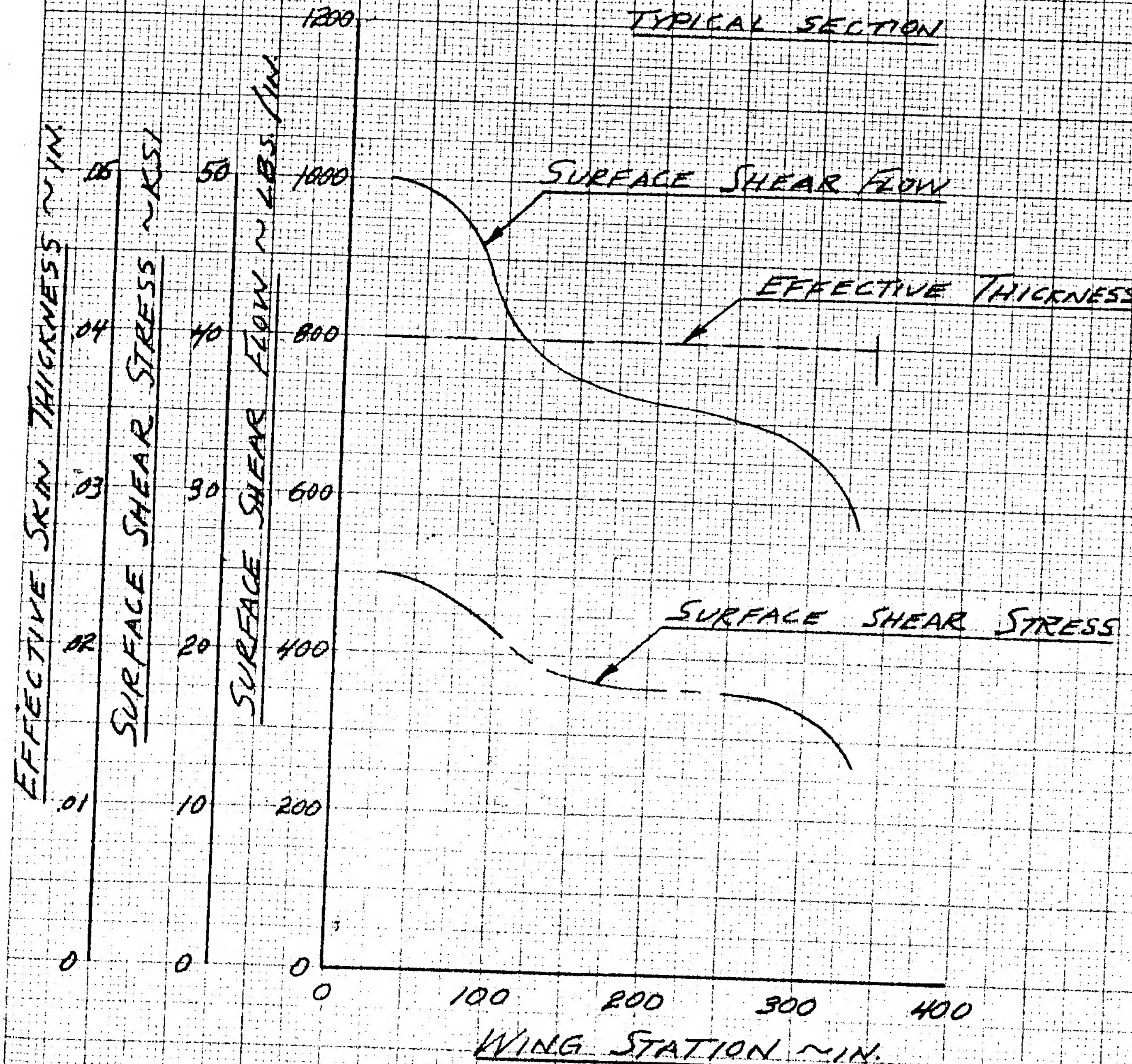


FIG. 11

WING SURFACE DESIGN



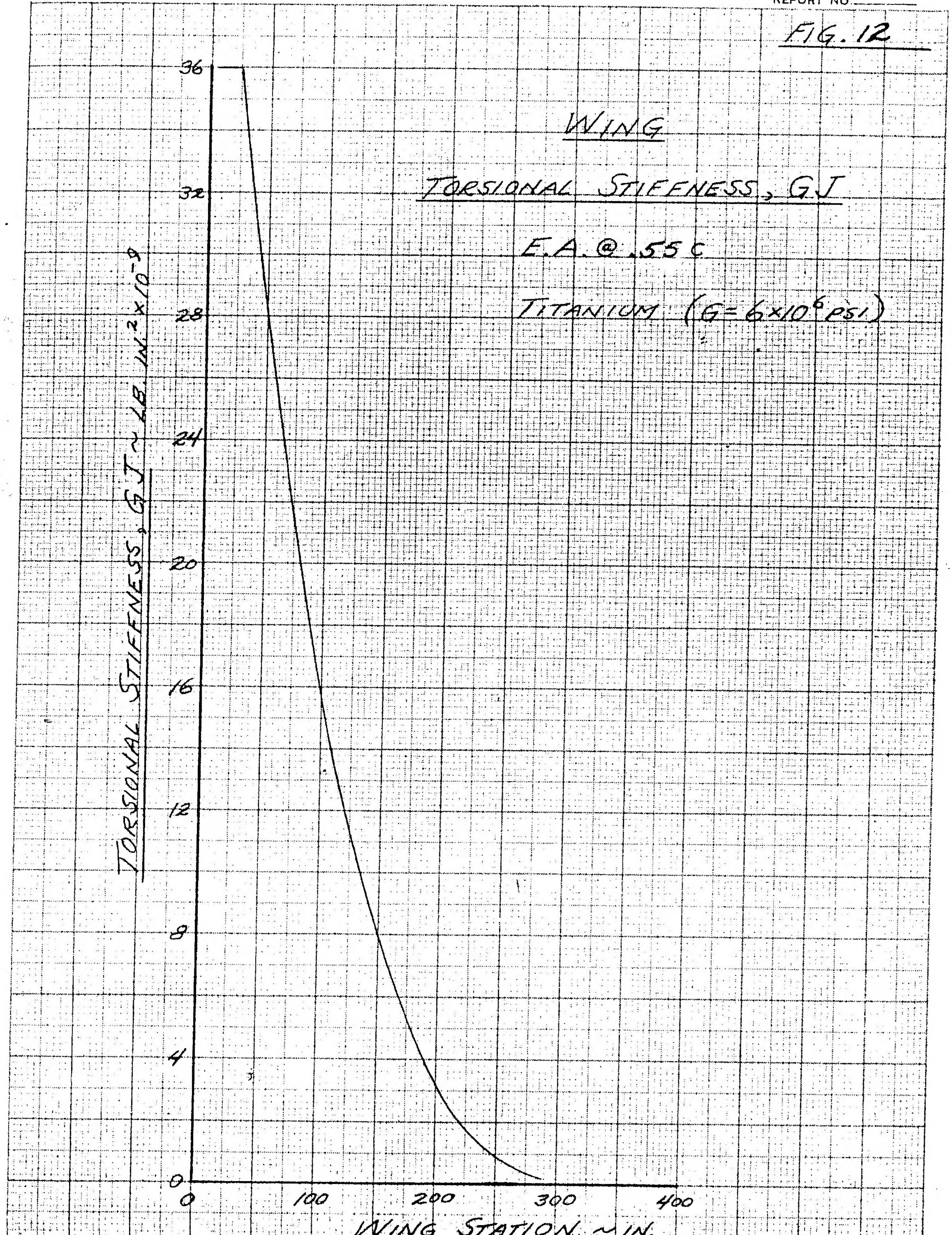
TYPICAL SECTION



DATE
CHECKED BY

LOCKHEED AIRCRAFT CORPORATION
CALIFORNIA DIVISION

PAGE 14-61
MODEL A-11
REPORT NO.



FORM 5278

FUSELAGE

Description

The fuselage consists of three major assemblies; the forward, mid and aft sections as noted on the Inboard Profile. The construction of the fuselage in three sections will greatly facilitate fabrication of the structure and installation of the functional equipment required in each section. The provision of service joints on these fuselage sections permits rapid disassembly of the aircraft for transporting purposes.

The forward fuselage section contains the Flight Station, Military Equipment compartment, nose landing gear, air conditioning compartment and suitable compartments for the installation of electronic, navigation and communication equipment. The remainder of the forward section contains the forward fuel tanks.

The mid fuselage section provides for attachment of the wing box section and contains the main landing gear and mid section fuel tanks.

The aft fuselage section provides for attachment of the aft portion of the fin box section and contains the aft section fuel tanks and the landing chute.

The fuselage fuel tanks are of the integral type providing maximum fuel capacity for a minimum size structure.

FUSELAGE (Continued)

Description (Continued)

The fuselage structure is of semi-monocoque construction, consisting of skin, rings and four longerons. Since most of the fuselage structure adjacent to the skin is subjected to high temperatures for long periods of time, the material used is a titanium alloy (B-120VCA). For internal structure, where temperature is maximum at 300°F, 2024T6 or 2024T81 aluminum alloys will be used. The minimum skin gage is .016 at the nose, increasing to a maximum of .040 at the center section. Rings will be of gage comparable to the skin except the main frames in the center section. Rings (2.0 in. deep channel sections) will be spaced approximately 15.0 in. c.c., with two (1.0 in. deep) Z section intermediate rings spaced between, giving a panel spacing of 5.0 c.c. Four longerons, B.L. 14.0, left and right, resist up and down bending moments. Side bending is resisted by tension in the side skin and B.L. 14.0 upper and lower longerons on the opposite side. Longerons will be formed sheet metal channels, with inner and outer caps tying the channels together. The outer cap also acts as a splice plate for the skin and rings, and the inner cap as a splice plate for the inner flange of the 2.0 in. deep rings. Spot welding will be used extensively because of weight, low cost, reliability and strength.

The fuselage shell will be made in four parts, spliced longitudinally at the longeron points. This "quarter shell" breakdown permits spotwelding

FUSELAGE (Continued)

Description (Continued)

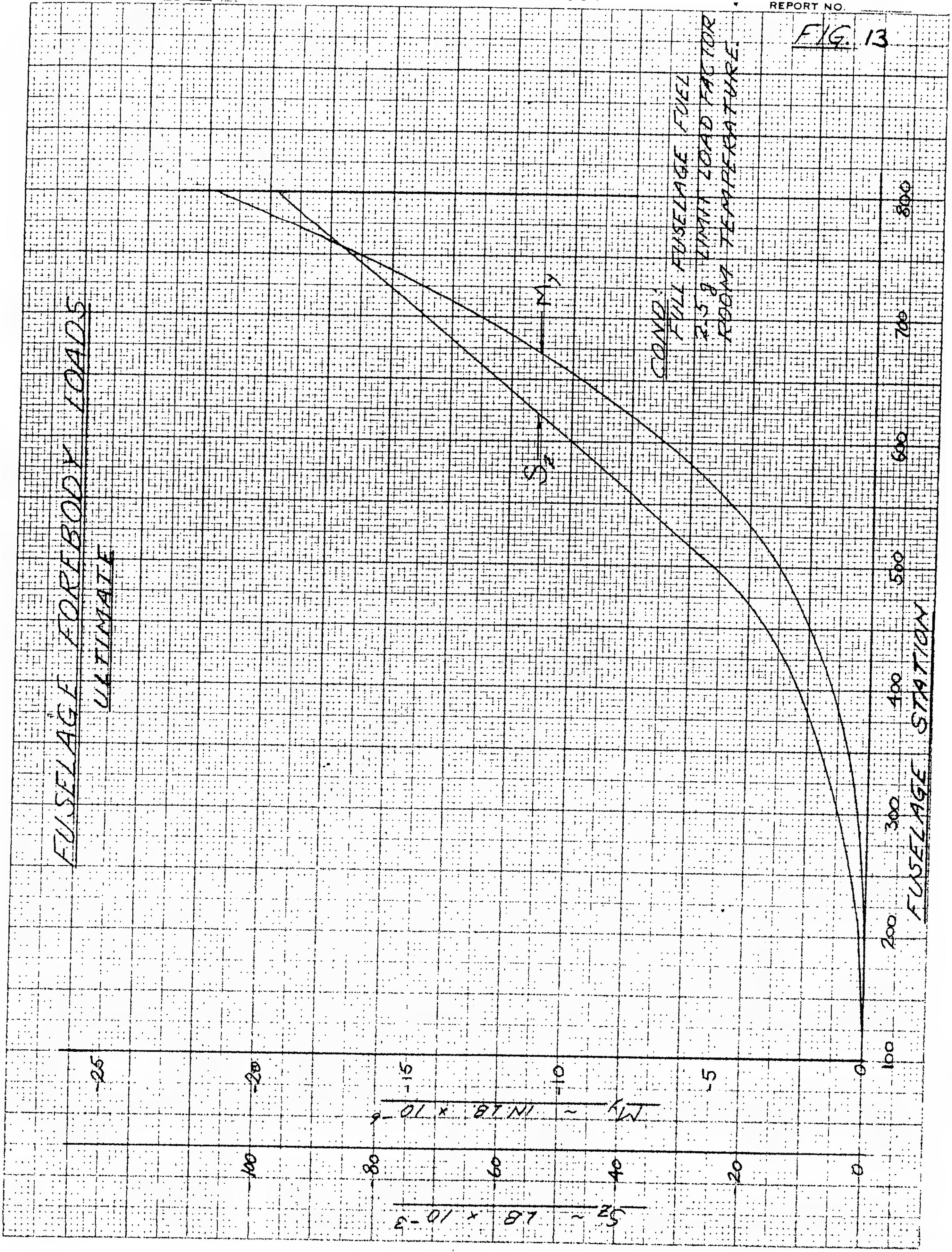
to be used extensively. The "quarter shells" will be spliced together by a maximum of two longitudinal rows of titanium (B-120VCA) rivets at each of the four longerons.

Figure 13 is a shear and moment curve, for the forward fuselage, critical for room temperature condition. The shear and moments for elevated temperature conditions are almost as critical. Figure 14 shows the longeron loads, areas, stresses, skin shear flows and skin thicknesses required. A detailed sketch, Figure 15, of typical lower longeron is shown. The upper longeron is similar but approximately half of the area of the lower longeron at any given fuselage station. Also a sketch, Figure 16, showing typical side shell construction and ring splice at longerons, is included.

The cockpit section is similar to the basic shell except that the upper longerons support the canopy and cockpit pressure loads. Pressure bulkheads in this area and other internal structure will be considered to be made of 2024ST aluminum alloy if temperatures are below 300°F.

Fuselage skin is also considered to carry internal pressure of 15.0 psi ult. due to fuel pressure in the fuselage fuel tank region. Surge bulkheads, where temperatures remain below 300°F will be made of 2024ST aluminum alloy.

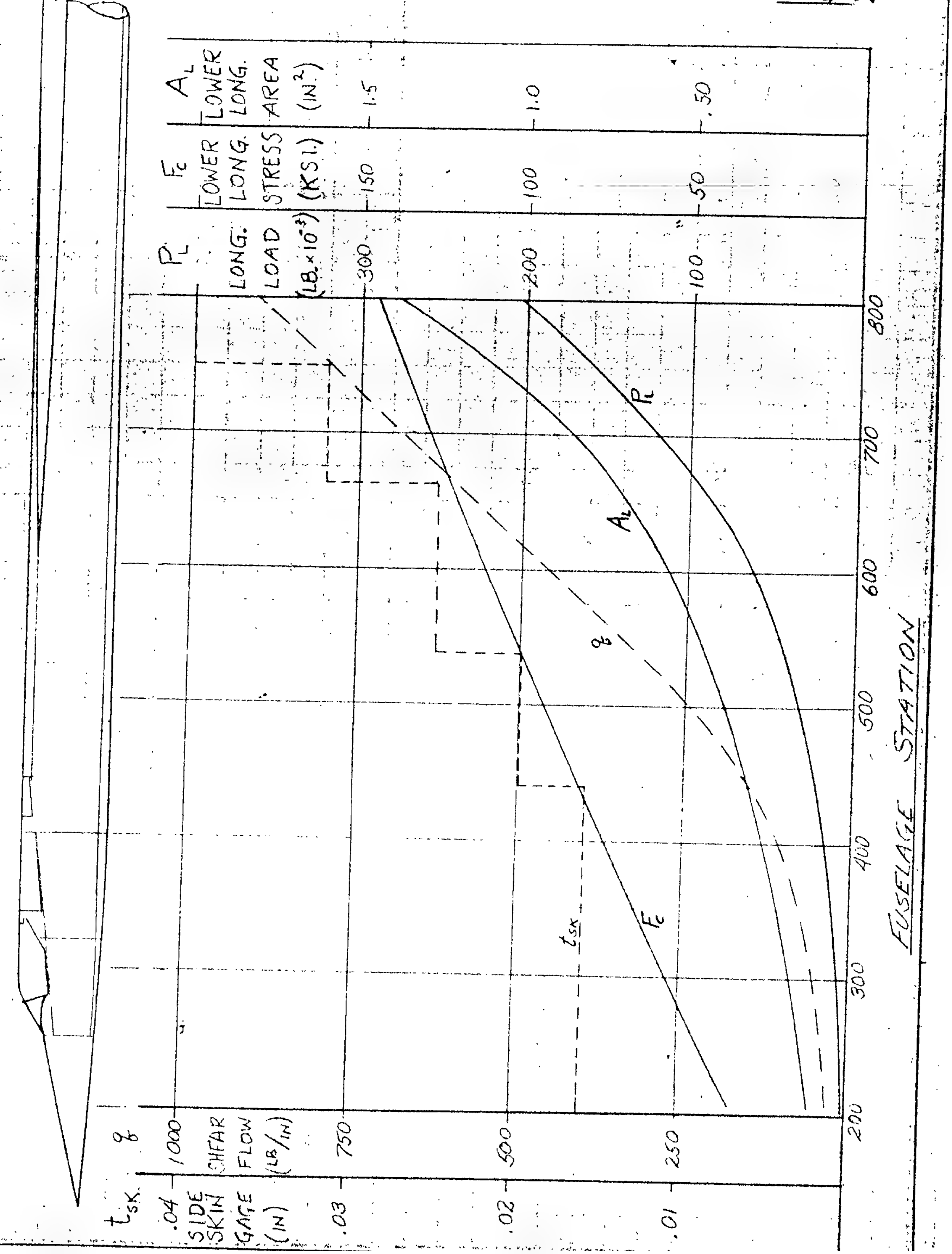
FIG. 13


FUSELAGE FOREBODY LOADS
ULTIMATE
COND: FULL FUSELAGE FUEL
2.5 g LIMIT LOAD FACTOR
ROOM TEMPERATURE
M_y
S_z
100
200
300
400
500
600
700
800
FUSELAGE STATION
-25
-20
-15
-10
-5
0
M_y ~ IN LB × 10^{-6}
100
80
60
40
20
0
S_z ~ LB × 10^{-3}

	NAME	DATE	LOCKHEED AIRCRAFT CORP.	Page	TEMP.	PERM.
Prepared					IV-32	
Checked			TITLE	Model	A-11	
Approved				Report No.		

BASIC FOREBODY STRUCTURE

FIG. 14



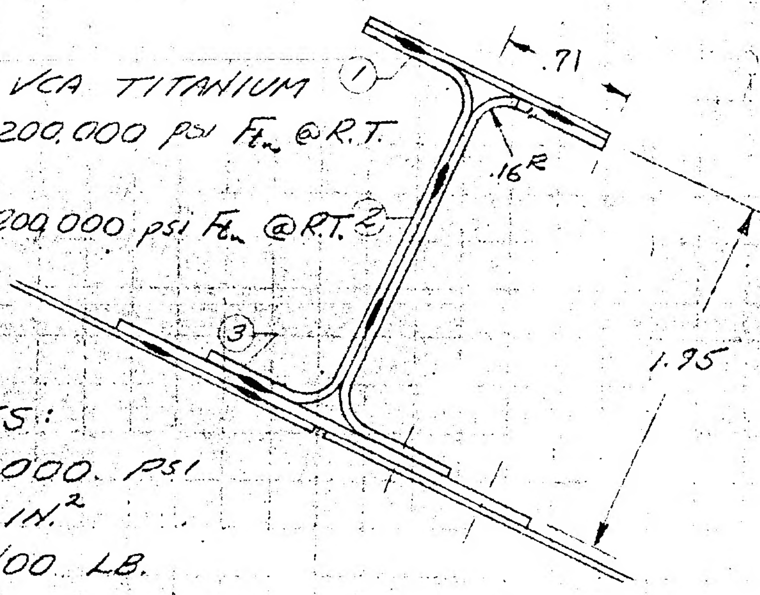
NAME		DATE	LOCKHEED AIRCRAFT CORP.	Page	TEMP.	PERM. IV-33
Prepared			TITLE	Model	A-11	
Checked						
Approved				Report No.		

FIG. 15

TYPICAL LOWER LONGERON SECTIONS

F.S. 600

MAT'L: B 120 VCA TITANIUM
SKIN: .032, 200,000 psi F_{tu} @ R.T. ①
REMAINDER:
.050, 200,000 psi F_{tu} @ R.T. ②

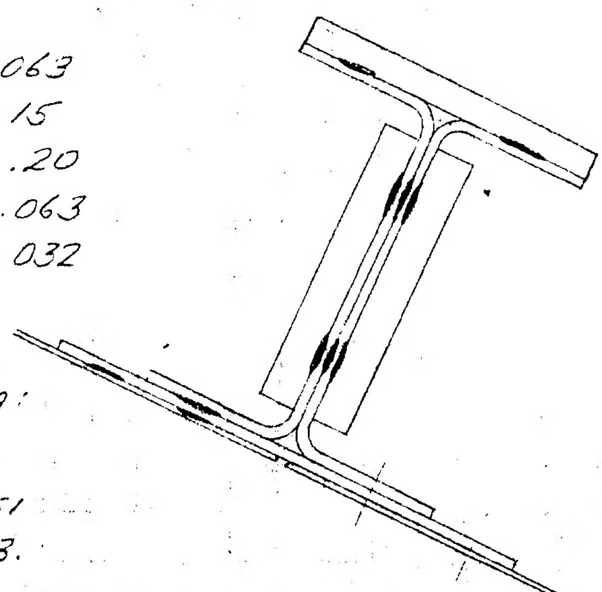


COMPRESSION ALLOWABLES:
F_c = 110,000 PSI
A_{eff} = .54 IN^2
P_{ALL} = 59,400 LB.

F.S. 300

MAT'L: B120 VCA TITANIUM
200,000 PSI F_{tu} @ ROOM TEMP

THICKNESSES:
CHANNELS ~ .063
TOP STRAP ~ .15
SIDE STRAPS ~ .20
SPLICE ~ .063
SKIN ~ .032



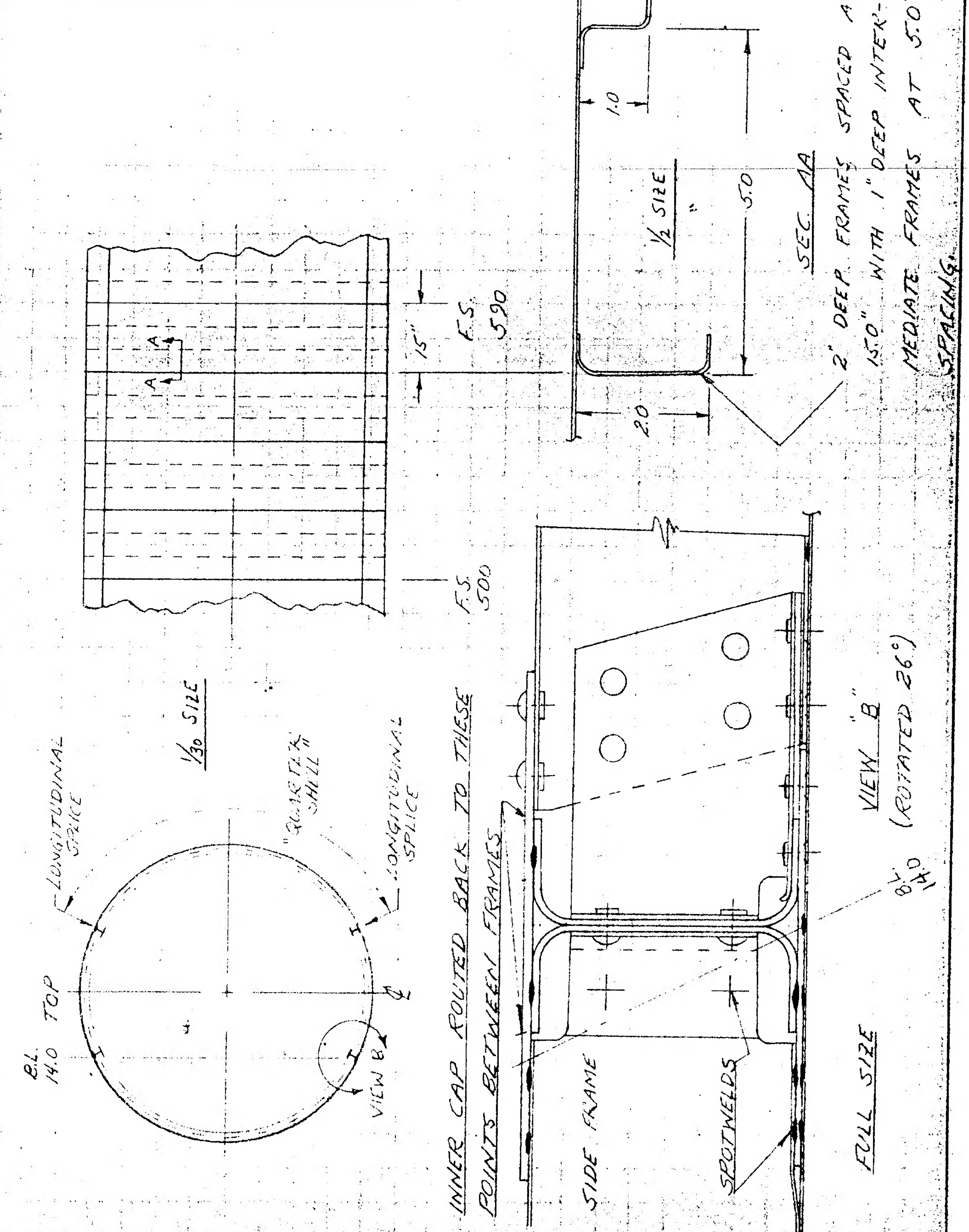
EFFECTIVE AREA:
1.40 IN^2
F_c = 145,000 PSI
P_{ALL} = 203,000 LB.

FORM B362-1

	NAME	DATE	LOCKHEED AIRCRAFT CORP.	Page	TEMP. IV	PERM. 34
Prepared			TITLE	Model	A-11	
Checked						
Approved				Report No.		

FIG. 16

TYPICAL SIDE SHELL



LANDING GEAR

The landing gear is of the conventional tricycle configuration with both main and nose gears retracting forward.

Static MG hub is at Sta. 915, WL 29.6. Static NG hub is at Sta. 477.5, WL 24.2.

The main gear stroke is 18½ in. and NG stroke is 15 in. With the ratio of 85,000 lbs. takeoff weight to 40,000 lbs. landing weight, and by virtue of the lengthy MG stroke, gear strength capabilities are determined mainly by ground handling conditions, (taxi, braking, and tow).

$$n_g \text{ (for landing)} = \frac{\left(\frac{V^2}{2g}\right)}{\eta_{STRUT}}$$

Assuming 7 ft./sec. sink speed and $\eta_{strut} = .9$,

$$n_g = \frac{49}{2x32.2x.9} = .84$$

and for the ground conditions, static loads, with CG at 25% MAC (Sta. 868) =

$$P_{V_{G_M}} = \frac{85,000}{2}\left(\frac{390.5}{437.5}\right) = 38,000 \text{ lbs.}$$

$$P_{V_{G_N}} = 85,000 - 76,000 = 9,000 \text{ lbs.}$$

The main gear tires are 40 x 12 of 26 ply rating. Nose gear tire is 26 x 6.6 EHP, Type VII.

COCKPIT ENVIRONMENT

The general arrangement of the cockpit, windshield and canopy is as shown in Figure 1.

This is the simplest and lightest configuration which we believe adequate to provide the required comfort and safety for the pilot in the flight regime which this airplane will encounter.

In this section the problems of air conditioning, emergency escape and personal equipment are given separate consideration.